Architectural Design against Crime Toward Crime Prevention through Modern Environmental Design

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Abstract— **There is no doubt that provision of security and safety is from the main objectives of the new urban planning, due to its impact on the individual and society, because of that the architects try to solve this problem throw an environmental design which called crime prevention through environmental design (CPTED). We will discuss in this study the design strategies for this way of design starting from the single family homes passing throw all neighborhood's units tell we reach to the economic and industrial buildings. We will discuss too some exterior and interior physical security procedures, modern technologies used to protect people against intruders, the procedures of the government to secure residential areas and how can the architecture help them doing their work. After finishing the design and implementation procedures, we list some of CPTED implementation benefits and problems, and offer some additional recommendations for people who will live in these places to enhance their feeling with safety and security.**
We find after consider all CPTED design benefits that it offer more safe and beautiful place for people to live in and it reduce the total cost of buildings since it use saving lighting system, building material and we will need less amount of physical security systems (CCTV, EAC,..) which are very expensive. The researcher taking into his account a lot of CPTED principals during design Future City project to make safe and secure city.

Keywords: **Environmental design, CPTED, Crime prevention, Physical security.**

I. INTRODUCTION

There is no doubt that provision of security and safety are the main objectives of the new Urban Planning because its significant impact on the individual and society, so we always strive to find security solutions to existing problems by creating a modern urban communities with special designs that limit the opportunities to commit crimes, or develop the existing cities to make them more safer, so we take into account some international standards in the design of these cities and applied them to facilities starting from individual homes through residential complexes, neighborhoods, buildings, car parking areas, offices, commercial markets, ...etc. and develop them to suit our cultural heritage. "We need stronger local communities and an improved quality of life. Streets where parents feel safe to let their children walk to school. Where people want to use the parks. Where graffiti, vandalism, litter and dereliction is not tolerated. Where the environment in which we live fosters rather than alienates a sense of local community and mutual responsibility (Tony Blair, 2001).

II. HOW ARCHITECTURE CONTROLS CRIME

Law enforcement is necessary and important, but even with substantial improvements, it will not fully succeed in crime prevention [1].

III. DESIGNING OUT CRIME- PRE DESIGN

Because of that the architecture tries to figure out some architectural solutions. There are three schools of thought that determine much of today's practice in designing out crime from the environment:

1) *Defensible Space* – including the idea that access points to an area should be restricted so that only those with a legitimate reason to be in a place would be there.
2) *Crime prevention through environmental design (CPTED)* – developing defensible space through the belief that the physical environment can be manipulated to influence behavior to reduce crime. This is the basis of Secured by Design.
3) *Situational Crime Prevention/2nd Generation CPTED* – extending defensible space and CPTED ideas to consider both management and design interventions that reduce the opportunities for crime; also by developing social and economic strategies with physical development to produce sustainable communities[2].

We will discuss in this research the third method Crime Prevention/2nd Generation (CPTED)

IV. WHAT IS CPTED?

CPTED is a proactive design philosophy built around a core set of principles that is based on the belief that the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime as well as an improvement in the quality of life (http://cptedontario.ca/mission/what-is-cpted/). Residential areas are the heart of a community. Our homes are the center of our lives, where we should feel most safe, so we should involve CPTED principles in our home design by using a three-step review process:

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1) *Designation:* What is the intended use of the area? What behavior is allowed?
2) *Definition*: Are there physical limitations to the area or site?
3) *Design:* Does the physical environment safely and efficiently support the intended use?

All CPTED recommendations must be viewed in relation to how the built or natural environment is used. What cultural definitions do the users bring to the space?

We should start our design from small units till we cover the whole town[3].

Residential Design Recommendations for:

Single Family Homes, Multi-Family Residences, Neighborhoods, Educational Facilities, Commercial Storefronts, Shopping Malls, Office Buildings, Industries, Parking Structures, Commercial Drive-Through (especially automatic teller machines (ATM), Commercial buildings(Banks)[3], [1].CPTED design consists of five main principles as shown in Fig (1)



Fig. 1: The Five Principles of CPTED

- Natural Surveillance is the placement of physical features, activities and people in such a way as to maximize visibility of the community. "To see and be seen." as shown in Fig (2)

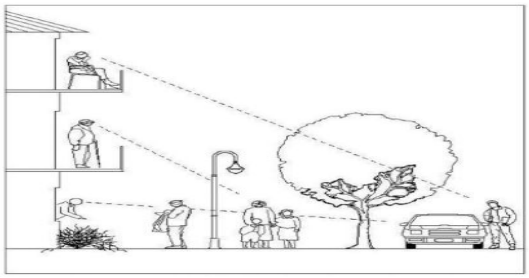


Fig. 2: How to Maximize Visibility

- Natural Access Control is the physical guidance of people coming and going from a space by the placement of entrances, exits, fencing, landscaping, and lighting.
- Territorial Reinforcement creates a clear delineation of space and separates your space from non-legitimate users.
- Activity Support places any activity in a location so that individuals become a part of the natural surroundings, creating "natural surveillance."
- Maintenance Routine and preventative maintenance helps ensure CPTED elements serve their intended purpose[5].

V. LANDSCAPING RECOMMENDATIONS

- Planting and selection of landscape material should be such that sight lines remain open and clear, and places of concealment are not fostered.
- Keep shrubs trimmed to two feet, or at least below window sills, when safety is an issue.
- Prune the lower branches of trees to at least six feet off the ground as shown in Fig (3)[3].

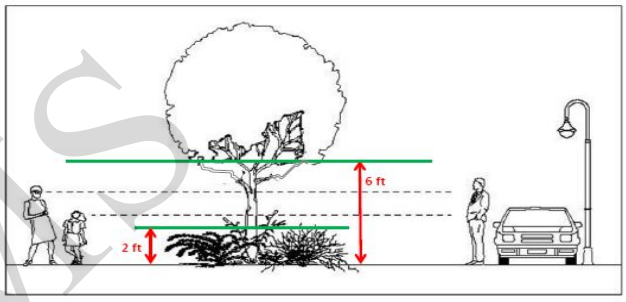


Fig. 3: Requirement for all levels is the 2ft/6ft Rule
Source: [5]

- If graffiti is a known problem in the area, specify thorny landscape plants as a natural barrier to deter unwanted entry.
- Specify vines or planted wall coverings to deter graffiti.
- Avoid blank spaces which may be an invitation to graffiti vandals.
- Provide landscape and fencing that do not create hiding places for criminals.
- Discourage crime by creating an inhospitable environment for criminals.
- Provide attractive and durable (masonry) fencing whenever possible.
- Consider creative solutions to fencing schemes which work aesthetically as well as functionally as shown in Fig (4).
- Use lighting in the landscaping both for security and aesthetics[3].
- Housing should be mixed with commercial and social facilities as this helps improve security in an area
- Parks and playgrounds should be overlooked by housing to afford natural surveillance[2].

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Fig. 4: Example of Good Landscape Model
Source: http://www.slideshare.net

VI. LIGHTING RECOMMENDATIONS

- Provide lighting systems which provide night time vision for motorists to increase the visibility of pedestrians, other vehicles and objects which should been seen and avoided.
- Design lighting systems for pedestrians, homeowners and business people to permit pedestrians to see one another, and to see risks involved in walking at night.
- Provide lighting systems which will enhance the ability for surveillance and observation.
- Provide lighting systems that minimize glare, shadow, light pollution and light trespass as shown in Fig (5) [3].

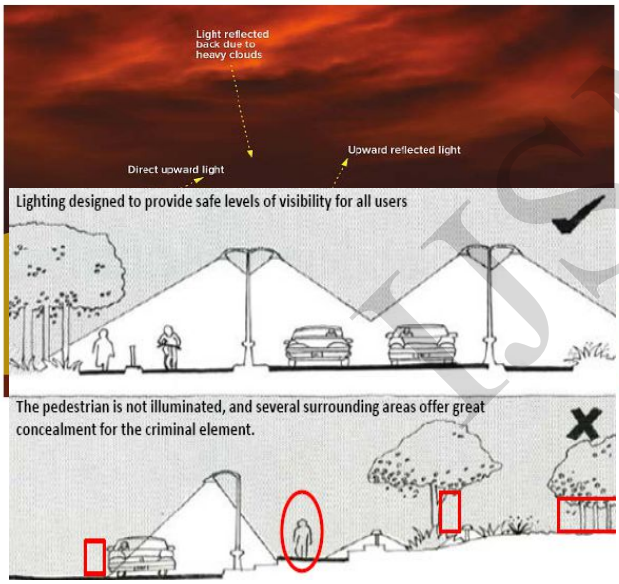


Fig. 5: Example of Good Lighting System
Source: [5]

VII. VARIABLE DESIGN FEATURES

A. Size

- Dwellings per block
- Dwellings per entrance
- Number of stores
- Flats or marionettes

B. Circulation

- Overhead walkways
- Connecting exits
- Connecting lifts and stairs
- Dwellings per corridor

C. Entrance variables

- Entrance type
- Entrance position
- Doors or apertures
- Stilts, garages, facilities.

D. Grounds

- Blocks per site
- Access points per site
- Play areas
- Spatial organization

VIII. DESIGN RECOMMENDATIONS FOR EXTERIOR PROTECTION

1. Perimeter Security Measures

- Perimeter protection is the first line of defense in providing physical security.
- In addition to defining the physical limits of a facility and controlling access.
- Every vulnerable point should be protected.
- The extent of perimeter controls will be determined.

2. Physical Barriers

3. Fencing

3.1 Chain link.
3.2 Barbed Wire.
3.3 Top guard.

4. Gates

4.1 The purpose of it is to provide a break in a perimeter fence or wall to allow entry.
4.2 Gates should be adequately lighted.
4.3 Intrusion detection devices may be desirable when the gate is used intermittently

5. Protective Lighting

6. Doors

6.1 A door is a vulnerable point of the security of any building.
6.2 Overhead roll doors not controlled or locked by electric power should be protected by slide bolts on the bottom bar.

7. Windows

7.1 Windows are another vulnerable point for gaining illegal access to a building.
7.2 Bars and steel grills can be used to protect a window.

9. Roof Openings

10. Mechanical Areas.

10.1 Prevent Public Access to Mechanical Areas.
10.2 Restrict Access to Building Operation Systems by Outside Maintenance Personnel.

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11. Building HVAC Systems.

11.1 Prevent Access to Outdoor Air Intakes.

- Relocate Outdoor Air Intake Vents.
- Extend Outdoor Air Intakes. .
- Establish A Security Zone Around Outdoor Air Intakes.

12.1 Secure Return Air Grilles.

13.1 Implement Security Measures, Such As Guards, Alarms, and Cameras To Protect Air Intakes or Other Vulnerable Areas.

14.1 Restrict Access To Building Information.

12. Fire Escapes and Building Walls

12.1 Normally, outside fire escapes do not provide an entrance directly into the building.

12.1 Walls are not normally considered possible points of entry because of their usual solid construction.

13. Facilities in Remote Locations

Large facilities located in sparsely inhabited areas have an inherent form of protection by virtue of their isolation [6].

IX. WHAT IS PHYSICAL SECURITY?

Physical Security is an aggregate word of electronic security solutions who are able to support us to monitoring assets. The most important parts are:

- Video Surveillance (CCTV, IP Cameras)
- Electronic Access Control (EAC)
- Biometric security: fingerprint, retina, iris, and voice scanners
- Intrusion Detection
- Paging systems [7, 8].

X. LAYERS OF PHYSICAL SECURITY

Ground entrance

✓ Gates, fences, security guards

Building entrance

✓ Generally just an employee badge

Individual room entrance

✓ ID badge, biometric scanners

Individual items

✓ Safes for backups, lock-and-keys for individual computers or servers

Each one can have multiple layers within itself

✓ E.g. a military base [9].

XI. LATEST CRIME-FIGHTING TECHNOLOGIES TO SECURE FACILITES (HTTP://WWW.TOPTENZ.NET)

- Automated license plate recognition cameras
- Brain Fingerprinting
- Shoe Printing
- Shot Spotting
- Plant DNA to knock off Counterfeiters
- 3-D Technology
- Property Marking System
- Vehicle Slowdown System
- Body Odor to sniff out criminals
- Vomit Inducing Flashlight

XII. TYPES OF CRIME IN RESIDENTIAL NEIGHBORHOODS

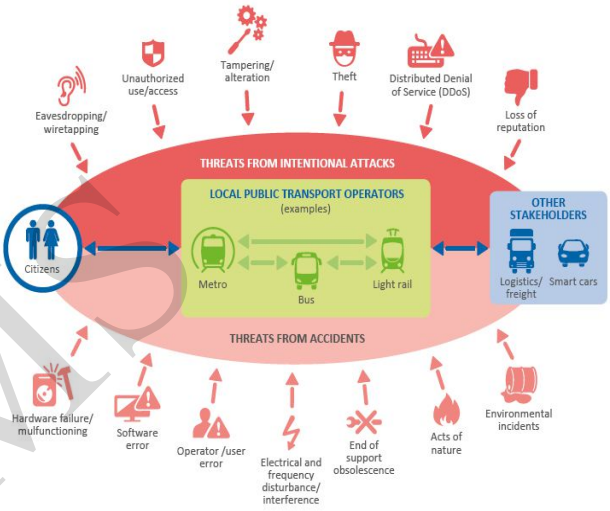


Fig. 6: Threat Landscape
Source: [10]

XIII. CPTED BENEFITS

- productive use of space
- improved function and/or profit
- reduced exposure to fear, crime, loss and liability
- partnerships and problem solving
- improved quality of life, and
- major cost savings (http://cptedontario.ca).

Community Residents will Have

- Opportunities to play meaningful roles in community crime prevention
- Improved sense of security
- Fewer crimes committed in neighborhoods, fewer victimizations of residents
- Increased interaction among residents and stronger neighborhood bonds
- New crime prevention and problem-solving skills and enhanced knowledge of city government agencies and other resources

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Municipal leadership will see

- Less crime in neighborhoods and business areas
- Improved perception of safety and livability in public areas and neighborhoods
- Enhanced consideration of public safety in planning, development, and redevelopment projects

Law enforcement will benefit from

- Sustainable links with planning, development, code enforcement, and other local agencies
- Clarification and action on neighborhood priorities related to crime and quality of life
- Opportunities to play meaningful roles in community crime prevention
- New crime prevention and problem-solving initiatives

Business leaders/owners will gain

- Safer locations that are more attractive to customers and employees
- Enhanced problem-solving partnerships with local government and community members

Planners/architects will gain

- A greater role in designing the environment; CPTED is recognized as an acceptable component of LEED (Leadership in Energy and Environmental Design) or Green Building
- A holistic approach to the development and planning process (http://www.ncpc.org).

XIV. PROBLEMS WITH IMPLEMENTING CPTED

Implementing CPTED is not without problems. Moffatt lists the following:

- Striking a balance between security and practicality on the one hand and aesthetics on the other is the main problem.
- Too much security promotes a fortress mentality.
- Environmental design must reduce criminal activity while maintaining aesthetic standards sought by architects.
- Because voluntary or compulsory security codes and standards for maintenance do not generally exist, because competition among proprietors has not generally extended to security, and because the essential role of the architect in security planning has not been widely recognized, landlords do not request that architects design for security, nor do building permit officials insist on it.
- Architects do not always know who is going to be living in the building they design and cannot therefore involve residents in the security planning process. As well, architects tend to be more concerned with ideal aesthetics than crime prevention .
- Police often regard resident involvement in the planning process as meddlesome .
- There are problems with some citizen patrols that are often part of crime prevention programs, e.g. participants losing interest, lack of volunteer's at the most vital times Such as late at night, and fractionalization. (Susan Geason and Paul R. Wilson 1989).

Table I. Comparison between Benefits and Problem of CPTED Implementation

CPTED benefits	Problems with implementing CPTED
Productive use of space	Balance between security and practicality
Improved function and/or profit	Too much security promotes a fortress mentality
Reduced exposure to fear, crime, loss and liability	Reduce criminal activity while maintaining aesthetic standards is dilemma
Partnerships and problem solving	Security designs has not been widely recognized by stockholders
Improved quality of life	Architects cannot involve residents in the security planning process
Major cost savings	Police often regard resident involvement in the planning process as meddlesome
Improved sense of security	Lack of volunteers at the most vital times such as late at night
Increased interaction among residents	
Government will have Less crime in neighborhoods and business areas	
Sustainable links with planning, development, code enforcement, and other local agencies	

XV. TWELVE TIPS FOR BEATING THE BURGLAR

The Australian Insurance Council has drawn up a list of a dozen tips to protect your home while you are away :

- Don't advertise your absence by allowing milk, newspapers and mail to accumulate.
- Don't hide keys outside the house.
- Don't leave blinds or curtains closed if you're away for some time.
- Don't forget to inform police of your absence and address while you're on holidays, and to advise your insurance company if the house will be unoccupied for longer than your policy allows.
- Don't leave notes for thieves to read.

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- Don't rely on outdated locks. Fit modern deadlocks on all outside doors.
- Don't leave ladders and tools around for thieves to use.
- Don't go out without locking all doors and windows of the house and outbuildings.
- Don't forget to arrange for a neighbor to collect free delivery newspapers, park a car in your drive and mow the lawn.
- Don't let shrubs grow beyond window level - they can provide hiding places.
- Don't forget to switch on external lighting at dusk and leave on as usual if out for the evening. Consider installing a time-switch for internal lights.
- Don't forget to keep a record-make, model, serial number and photograph-of all valuables kept at home.

XVI. SAFETY TIPS FOR APARTMENT DWELLERS

- When choosing an apartment, try to rent or buy in a security building, that is, one with a caretaker, or entry phones. If you own a unit in an insecure building, work through the body corporate to initiate a security system.
- Install reliable deadlocks on all exterior doors and if you are on the ground floor, install security locks on windows and balcony doors.
- Install a peephole in your front door so that you don't have to open your door to strangers. And always check the identification of tradespeople or public utility workers who present themselves at your door.
- Have a chain on your door so you do not have to open it completely until you have checked the credentials of strangers. It also gives you protection at night when you might not wish to deadlock yourself in, in case of fire or emergency.
- Keep a list of emergency numbers - police, fire brigade etc. near your phone.
- Make friends with your neighbors, surveillance by neighbors is the most effective deterrent for thieves after signs of occupancy.
- Do not indicate your sex on your mailbox: write J. Brown rather than Jane Brown .
- Make sure lobbies, stairwells and the area outside the apartment entrance is well lit.
- Work through the owners or the body corporate if necessary.
- Do not buzz in strangers through your entry phone system, or let strangers in when you are coming in the front door of the building even if they say they have friends in the building or that they are tradesmen.
- Body corporates should initiate a security information program for new owners or tenants so that security standards are maintained.
- Organize a neighborhood watch for your apartment building [11].

XVII. ECONOMICAL POINT OF VIEW AND SOME OBSERVATIONS

- CPTED principals have an impact on almost every aspect of construction, including site and building layout, landscaping, fencing, and wall construction, just to name a few. CPTED can even influence the colors used to paint walls and ceilings or the types of floor materials used. One exciting thing is that it doesn't have to cost extra money to implement CPTED principals; in fact, effectively using CPTED can often reduce the total cost of construction as well as reduce ongoing operating costs (http://www.silvaconsultants.com) since it reduce the amount of the technical security systems (i.e. CCTV, EAC,….) needed in the locations by offering good design to the entrances and the hole building.

XVIII. A STRATEGY FOR SAFE STREETS AND NEIGHBORHOODS

There will be some actions will be taken into account during secure the city:

Action1. Encourage and assist law enforcement agencies to move towards intelligence-led, data-driven policing strategies by requiring agencies to submit crime data on a monthly basis.

Action2. Perform local assessments of gang problems and create interagency task forces to target violent gangs and gun violence.

Action3. Stop the flow of illegal and deadly guns into the state and vigorously investigate all shootings.

Action4. Combat witness intimidation through witness protection programs and minimizing reliance on civilian witnesses.

*Action*5. Involve community in identifying law enforcement priorities and strategies and preventing violence.

Action6. Coordinate State-level prevention efforts, beginning with the awarding money in grants through a competitive bidding process.

Action7. Facilitate and encourage local-level planning and implementation of prevention strategies.

Action8. Provide jobs and training to at-risk youth.

*Action9***.** Encourage the use of evidence-based primary prevention programs and use targeted outreach to maximize participation.

Action10. Evaluate and assess effectiveness of prevention programs.

Action11. Coordinate and create accountability for reentry through creation of Reentry Coordinating Council.

Action12. Launch a reentry Demonstration Project, with focused programming for up to 1,300 offenders.

Action13. Increase support and opportunities for youth returning home from Juvenile Justice Commission institutions.

Action14. Address unique needs of reentering ex-inmates through system-wide change.

Action15. Modify certain barriers to reintegration, with a focus on relieving impediments for persons who establish rehabilitation[12].

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XIX. ARCHITECTURE CAN FACILITATE LAW ENFORCEMENT IN FIVE RESPECTS

First, it can help police catch criminals, i.e. erected a series of concrete barriers in possible ways of escape of criminals to obstruct their movement.

Second, architecture can make it easier for police to intervene in an evolving incident, i.e. Police are more comfortable going into areas with strong natural surveillance and are more likely to enter peacefully when they believe that residents will take care of them and monitor the situation.

Third, the presence of many bystanders at a crime scene can increase the level of trust between police and the bystanders, leading the police to additional information, i.e. a crowd of bystanders is less likely to fear a police officer than are one or two bystanders. Therefore, as architects bring natural surveillance to an area, they may ease community-police tensions.

Fourth, architecture can facilitate the identification of criminals after a crime has been committed, i.e. by putting more people on the streets and lighting facilities properly, a city makes it more likely that a given crime will be observed. A higher probability of accurate witness information thus exists when architectural design strategies are employed.

Fifth, an understanding of architecture and crime can help police deploy their resources in areas where crime is likely to fester, i.e. the physical environment affects the task of police to the extent that opportunities for crime are structured. To the extent that there are fewer places where offenders may operate freely, either because of environmental effects on offenders or on citizens, the task of police patrol is made easier [1].

XX. CONCLUSION

In many parts of the world, cities are growing by leaps and bounds. As they do so, here is come the need for safe streets and neighborhoods, the solution? Environmental design to reduce criminal activities. CPTED and physical security are needed in development, especially for architects, to built environment against crime, you needed to know people needs and problem and site condition, from topics previously studied by discussion and analysis I can confirm that:

- Architect can facilitate law enforcement,
- public areas can be designed more visible, make it difficult for crime and escape,
- good design can modify the social norms of a community,
- develop trust among neighbors,
- design can make crime more expensive, thereby creating cost deterrence,
- and the focus on natural surveillance suggests.

We have to create strategies that meet customer needs, the cost must be calculated well and the designs must be in the right place at the right time, also the study confirm problems with implementation, so it is necessary to rethinking in the basis for Crime Prevention Strategies to produce designs fit the purpose and suitable for users

Taken into account three basics user needs, security procedures and CPTED strategies with the main problems and benefits of CPTED design; I suggest a new vision to solve some of CPTED problems as shown in Fig (7).

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- http://www.slideshare.net

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Table II. The Conclusion

Architecture Design Against Crime	**Pre design**	**Chose the most suitable way in design out of crime (CPTED)**		
	Design & Construction	**CPTED Design Strategies**	**Natural Surveillance**	Placement of physical features, activities and people in such a way as to maximize visibility of the community
			Natural Access Control	Physical guidance of people by the placement of entrances, exits, fencing, landscaping, and lighting.
			Territorial reinforcment	Creates a clear delineation of space and separates your space from non-legitimate users
			Activity Support	Places any activity in a location so that individuals become a part of the natural surroundings, creating "natural surveillance."
			Maintenance	Routine and preventative maintenance helps ensure CPTED elements serve their intended purpose.
		Physical Security	**Ground entrance**	Gates, fences, security guards
			Building entrance	i.e. employee badge
			Individual room entrance	ID badge, biometric scanners
			Individual items	Safes for backups, lock-and-keys for individual computers or servers
	Post occupancy	**Law role in streets and neighborhoods secuity**		
	Observations	**CPTED benefits**		Productive use of space Improved function and/or profit Reduced exposure to fear, crime, loss and liability Partnerships and problem solving Improved quality of life Major cost savings
		Problems with implementing CPTED		Balance between security and practicality Much security promotes a fortress mentality Maintaining aesthetic standards is dilemma Not widely recognized by stockholders Residents couldn't be involved in planning Lack of volunteers at the most vital times
		How can architects facilitate law enforcement		They can help police catch criminals Police can intervene in an evolving incident Increase the level of trust between police and the bystanders Facilitate the identification of criminals Deploy resources in crime areas

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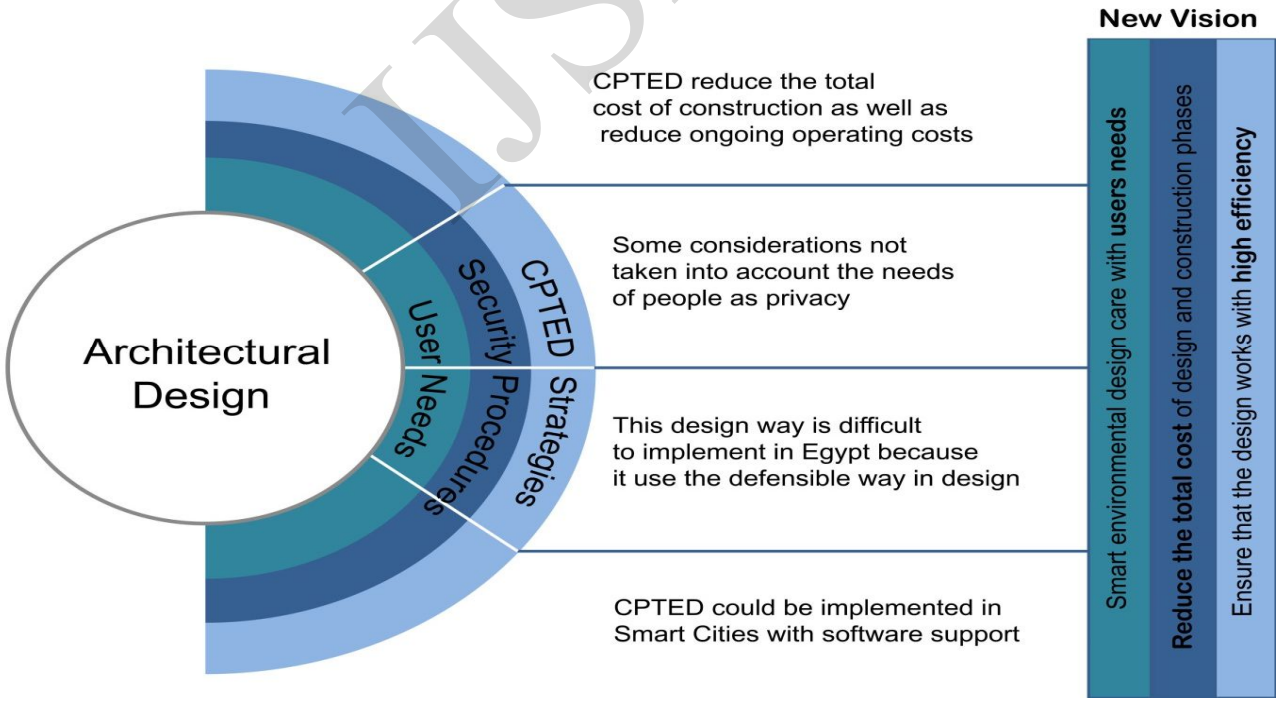


Fig. 7: Study Opservations